(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 590 945 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
25.02.1998 Bulletin 1998/09

(51) Int Cl.[6]: **F28D 1/02**, F28D 1/053, F28F 9/04 // F28F9/16

(21) Application number: **93307701.8**

(22) Date of filing: **29.09.1993**

(54) Vehicle radiator

Fahrzeugkühler

Radiateur de véhicule

(84) Designated Contracting States:
DE ES FR GB IT

(30) Priority: **30.09.1992 SE 9202819**

(43) Date of publication of application:
06.04.1994 Bulletin 1994/14

(73) Proprietor: **Valeo Engine Cooling Aktiebolag**
294 02 Sölvesborg (SE)

(72) Inventors:
- **Saboune, Michel**
  S-294 00 Sölvesborg (SE)
- **Golm, Norman**
  S-294 00 Sölvesborg (SE)
- **Furekull, Jan**
  S-290 34 Fjälkinge (SE)

(74) Representative: **Richards, David John et al**
PAGE, WHITE & FARRER
54 Doughty Street
London WC1N 2LS (GB)

(56) References cited:

EP-A- 0 000 189	EP-A- 0 164 327
EP-A- 0 505 243	EP-A- 0 505 244
WO-A-86/07628	WO-A-90/14571
CH-A- 369 777	DE-A- 2 847 525
DE-A- 3 327 335	FR-A- 2 261 493
US-A- 1 701 752	US-A- 3 438 432
US-A- 4 360 060	US-A- 4 524 823

EP 0 590 945 B1

Printed by Jouve, 75001 PARIS (FR)

Description

The present invention relates to a vehicle radiator consisting of a heat exchanger assembly comprising at least two rows of flat liquid-conducting tubes and fin units which are arranged between each pair of tubes in the respective row and adapted to guide air flowing through the heat exchanger assembly in the transverse direction of the rows of tubes; an inlet tank connected to a first end of the heat exchanger assembly for receiving heated liquid from the engine block of the vehicle and for distributing this liquid to the tubes; and an outlet tank connected to a second end of the heat exchanger assembly for receiving cooled liquid from the tubes and discharging it into the engine block, said inlet and outlet tanks each having a connecting plate with a number of connecting holes for the tubes.

Current trends in the design of vehicles, especially automobiles and trucks, are resulting in reduced space in the engine compartment. The room available for the various components is reduced. Some components can be made smaller for adaptation to the reduced space. Other components cannot be reduced in size by downscaling, since the capacity of the component is then decreased. A component of this type is the vehicle radiator.

A known type of vehicle radiator is illustrated diagrammatically in Figure 1 of the accompanying drawings. The radiator consists of a heat exchanger assembly 21, an inlet tank 22 and an outlet tank (not shown). The inlet tank in Figure 1 is represented by its connecting plate 24. The heat exchanger assembly consists of two rows of flat tubes 25 and, alternating with the tubes, interposed fin units 26. The construction of the fin units and the function of the radiator are well known to the person skilled in the art and will not be described in detail below. The tube ends are inserted into and soldered around the edges of holes punched out of the connecting plates.

This known radiator has a number of disadvantages. First, the tube ends inserted in the inlet tank and outlet tank, respectively, create turbulence and slow the low of heated water from the cooling channels in the engine block to the tubes in the heat exchanger assembly. Second, the connection between tube and connecting plate is weak. Third, the necessary distance between the rows of holes in the connecting plates creates a gap through the heat exchanger assembly. No heat transfer takes place in this gap. For practical reasons, however, the fin units are allowed to extend across the gap too, which creates an unnecessary pressure drop for the air flowing through.

EP-A-0505244 discloses a number of prior art radiator constructions. In one of these structures, a connecting plate has a plastics connector plate having plural holes for the flow of coolant, each hole being surrounded by a body which defines an annular slot spaced from and surrounding the respective hole. Tube ends are inserted into the slots and are secured to the connecting plate by the use of adhesive.

In another embodiment of the prior art, two tubes bear against one another, but the ends of two tubes are supported in a single hole in the connecting plate.

The principal object of the invention is to eliminate the abovementioned disadvantages of known radiator constructions.

A further object is to provide a radiator which is more efficient than the known radiator construction and which at the same time takes up less space in the engine compartment.

According to the present invention there is provided a vehicle radiator consisting of a heat exchanger assembly comprising two rows of liquid-conducting tubes and fin units which are arranged between each pair of tubes in the respective row and are adapted to guide air flowing through the heat exchanger assembly in the transverse direction of the rows of tubes; an inlet tank connected to a first end of the heat exchanger assembly for receiving heated liquid from the engine block of the vehicle and for distributing this liquid to the tubes; and an outlet tank connected to a second end of the heat exchanger assembly for receiving cooled liquid from the tubes and discharging it into the engine block, said inlet and outlet tanks each having a connecting plate formed with a corresponding number of connecting holes for the tubes, said connecting plates being provided at the location of each hole with a connecting piece projecting from the tank, and the ends of the tubes being widened and pushed onto the projecting connecting pieces whereby the tubes do not project into the tank characterised by the tubes being flat, said end portions being soldered to the connecting piece of the respective connecting plate to form a tight and stable connection between the connecting plate and the tubes and that the tubes of one row bear against the tubes of the other row along their flat portions.

One advantage of the radiator according to the invention is that the connection between the heat exchanger assembly and the connecting plates can be made stronger by virtue of the insertion of the connecting pieces into the tube ends. The strength of the construction can be increased further if the tubes of the first row are connected to the corresponding tubes of the second row in those tube portions, in each row, which bear against each other.

Another advantage of the radiator according to the invention is that the end of one tube is at all times in the same plane as the corresponding ends of the other tubes. This gives a radiator construction with a well-defined distance between the connecting plates, even if the flat tubes have different lengths prior to the widening of the ends of the tubes. The reason for this is that the widening of the tube ends shortens the tube from, for example, 500 mm to 498 mm. Any differences in the original tube length are eliminated during the widening of the tube ends. The widened portions "take up" these differences in tube length and guarantee that the fin-

ished tubes have the same length.

The invention will now be described in detail below with the aid of an embodiment given by way of example only and with reference to the attached drawings, in which

Fig. 1 shows diagrammatically a known vehicle radiator.

Fig. 2 shows in an exploded view, and diagrammatically, a vehicle radiator according to the invention.

gives a total weight reduced by approximately 12% as a result of a reduced amount of material in tank, connecting plate and fin unit. In addition, the pressure drop in the air flow is reduced by approximately 18% as a result of the reduced thickness.

The design of connecting plates with connecting pieces leads to a reduced pressure drop in the water flowing through the radiator, since the tubes do not project into the tank. The connection between the tube

anordnung strömende Luft in einer quer zu den Rohrreihen verlaufenden Richtung führen, einem an einem ersten Ende der Wärmetauscheranordnung montierten Einlaßbehälter zur Aufnahme einer aus dem Motorblock des Fahrzeug zuströmenden erwärmten Flüssigkeit und deren Verteilung auf die Rohre sowie einem an einem zweiten Ende der Wärmetauscheranordnung angeordneten Auslaßbehälter zur Aufnahme der gekühlten Flüssigkeit aus den Rohren und deren Rückleitung in den Motorblock besteht, wobei der Einlaß- und Auslaßbehälter jeweils eine Anschlußplatte mit einer Reihe von Anschlußöffnungen für die Rohre aufweist und diese Anschlußplatten (2,3) an jeder Öffnung (5) jeweils ein aus dem Behälter vorstehendes Verbindungselement (6) tragen, und wobei die Enden der Rohre (9) aufgeweitet sind und auf diese vorstehenden Verbindungselemente aufgeschoben werden, so daß die Rohre selbst nicht in den Behälter hineinragen, **dadurch ge kennzeichnet, daß** die Rohre flach sind, daß die genannten Rohrenden mit dem Verbindungselement der jeweiligen Anschlußplatte zu einer dichten und stabilen Verbindung zwischen Anschlußplatte und Rohren (2,3) verlötet werden, und daß die Rohre einer Reihe an den Rohren der anderen Reihe entlang ihrer flachen Teile anliegen.

2. Fahrzeugkühler gemäß Anspruch 1, **dadurch gekennzeichnet, daß** die Rohre der einen Reihe und die entsprechenden Rohre der anderen Reihe an ihren Berührungspunkten miteinander verlötet sind.

Revendications

1. Radiateur de véhicule constitué d'un ensemble d'échangeur de chaleur comprenant deux rangs de tubes conducteurs de liquide et des groupes d'ailettes qui sont placés entre les tubes voisins de chaque rang et faits pour guider l'air qui traverse l'ensemble d'échangeur de chaleur dans la direction transversale des rangs de tubes, un réservoir d'entrée joint à une première extrémité de l'ensemble d'échangeur de chaleur et destiné à recevoir du liquide échauffé du bloc moteur du véhicule et distribuer ce liquide aux tubes, et un réservoir de sortie joint à une deuxième extrémité de l'ensemble d'échangeur de chaleur et destiné à recevoir du liquide refroidi des tubes et l'envoyer dans le bloc moteur, ces réservoirs d'entrée et de sortie ayant chacun une plaque d'assemblage pourvue d'un nombre correspondant de trous d'assemblage pour les tubes, les plaques d'assemblage (2, 3) étant pourvues à l'endroit de chaque trou (5) d'une pièce d'assemblage (6) saillant du réservoir, et les extrémités des tubes (9) étant élargies et poussées sur les pièces d'assemblage saillantes, de sorte que les tubes n'entrent pas dans le réservoir, caractérisé par le fait que les tubes sont plats, leurs parties d'extrémité sont soudées à la pièce d'assemblage de la plaque d'assemblage respective pour la formation d'une assemblage étanche et stable entre la plaque d'assemblage et les tubes (2, 3), et les tubes d'un rang s'appuient contre ceux de l'autre rang le long de leurs parties plates.

2. Radiateur de véhicule selon la revendication 1, caractérisé par le fait que les tubes d'un rang et les tubes correspondants de l'autre rang sont soudés ensemble à leurs points de contact.

FIG.1

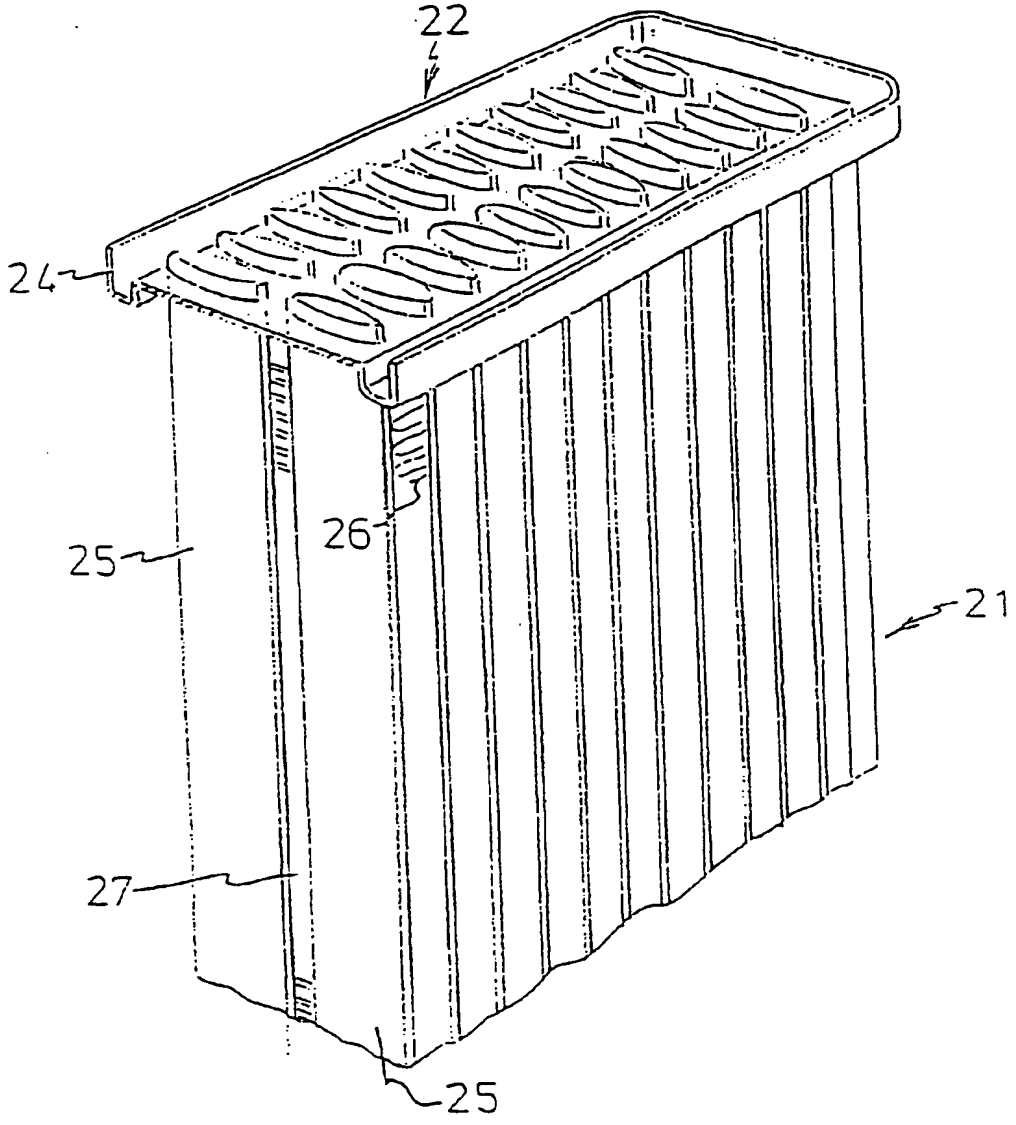

FIG. 2